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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/628,477	07/31/2000	Patrick H. Dussud	MS146913.1/40062.79-US-01	5539

7590 04/21/2004  
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EXAMINER

LY, ANH

ART UNIT PAPER NUMBER

2172

DATE MAILED: 04/21/2004

12

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/628,477

Applicant(s)

DUSSUD, PATRICK H.

Examiner

Anh Ly

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4, 11-14 and 20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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### DETAILED ACTION

1. This Office Action is response to Applicant's response filed on 03/29/2004.
2. Claims 1-20 are pending in this application.
3. Claims 5-10 and 15-19 are allowed

### *Claim Rejections - 35 USC § 103*

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-4, 11-14 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6,289,360 issued to Kolodner et al. (herein Kolodner) in view of 5,787,447 issued to Smithline et al. (hereinafter Smithline) and further in view of US Patent No. 5,440,746 issued to Lentz.

With respect to claim 1, Kolodner discloses performing a plurality of garbage collection phases (mark and sweep phases: col. 2, lines 1-18), each processor performs each of the phases on the heap dedicated to the processor using a garbage collection

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thread executing on the processor (collector threads to force synchronization process: col. 3, lines 25-45 and col. 5, lines 4-14).

Kolodner teaches a concurrent garbage collector for a heap implemented in a shared memory having mark and sweep phases and synchronization between sweep and allocated of a newly created object in a concurrent garbage collection. Kolodner does not teaches logically dividing the memory into a plurality of heaps, each heap dedicated to one processor for garbage collection (the beginning phase and the ending phase of the mark-sweep cycle and the synchronization process is between the mark-sweep phases: abstract, col. 2, lines 57-67; also col. 3, lines 25-45 and col. 5, lines 44-61). Smithline teaches each of a plurality of heaps stored in a memory of a data processing system (col. 2, lines 9-15; also see abstract, lines 1-4 and col. 1, lines 9-12). In combination, Kolodner and Smithline do not teaches synchronizing the processors so that all processors have completed the preceding phase prior to each processor beginning the next phase.

However, Lentz teaches synchronization of processors in a parallel processing environment (col. 1, lines 8-47 and col. 3, lines 2-18).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Kolodner in view of Smithline and with the teachings of Lentz so as to obtain synchronization for plurality of processors in garbage collection in order to include a plurality of heaps, and each heap is associated for each processor for garbage collection. This combination would have

made the system having synchronization between the phases in a plurality of heaps in shared memory having sweep and mark phases in a multiple processors environment.

With respect to claim 2, Kolodner discloses for each processor performing a phase of the garbage collection process, upon completion of the phase of the garbage collection process waiting for the other processors to complete the phase of the garbage collection process (col. 10, lines 8-18 and lines 48-55); and once the other processors have completed the phase of the garbage collection process, beginning the next phase of the garbage collection process (col. 5, lines 44-61; also col. 2, lines 32-42).

With respect to claim 3, Kolodner discloses a marking phase that marks all reachable objects in memory; a planning phase that plans the relocation of the objects; a relocation phase that updates the object references based on information calculated by the planning phase; and a compaction phase that compacts the reachable objects in memory (collection mark-sweep cycle: see fig. 7; also fig. 6, col. 10, lines 8-47, see abstract and fig. 10, col. 11, lines 25-31).

With respect to claim 4, Kolodner discloses analyzing each memory object to retrieve references to other memory object; if a reference to another memory object is present, analyzing the reference information to determine which heap the referenced object is associated; analyzing the directory of the heap for the referenced object to determine a new address location of the referenced object; and updating the reference information in the memory object (col. 10, lines 8-47, col. 11, lines 65-67 and col. 12, lines 1-12).

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Claim 11 is essentially the same as claim 1 except that it is directed to a computer program product readable by a computer rather than a method, and is rejected for the same reason as applied to the claim 1 hereinabove.

Claim 12 is essentially the same as claim 2 except that it is directed to a computer program product readable by a computer rather than a method (col. 5, lines 44-61; also col. 2, lines 32-42), and is rejected for the same reason as applied to the claim 2 hereinabove.

Claim 13 is essentially the same as claim 3 except that it is directed to a computer program product readable by a computer rather than a method (collection mark-sweep cycle: see fig. 7; also fig. 6, col. 10, lines 8-47, see abstract and fig. 10, col. 11, lines 25-31), and is rejected for the same reason as applied to the claim 3 hereinabove.

Claim 14 is essentially the same as claim 4 except that it is directed to a computer program product readable by a computer rather than a method (col. 10, lines 8-47, col. 11, lines 65-67 and col. 12, lines 1-12), and is rejected for the same reason as applied to the claim 4 hereinabove.

With respect to claim 20, Kolodner discloses a plurality of garbage collection modules for reclaiming unused memory objects located within the shared memory, each garbage collection module associated with a processing unit, each garbage collection module operates (see fig. 2 and col. 2, lines 50-67 and col. 3, lines 1-3 and col. 5, lines 62-67; module or sequence of instructions as computer programs: col. 7, lines 50-67

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and col. 8, lines 1-6; and reclaiming the memory in the sweep and mark phases: col. 2, lines 1-67).

Kolodner teaches a concurrent garbage collector for a heap implemented in shared memory having mark and sweep phases and synchronization between sweep and allocated of a newly created object in a concurrent garbage collection. Kolodner does not teaches logically dividing the memory into a plurality of heaps, each heap dedicated to one processor for garbage collection (the beginning phase and the ending phase of the mark-sweep cycle and the synchronization process is between the mark-sweep phases: abstract, col. 2, lines 57-67; also col. 3, lines 25-45 and col. 5, lines 44-61). Smithline teaches each of a plurality of heaps stored in a memory of a data processing system (col. 2, lines 9-15; also see abstract, lines 1-4 and col. 1, lines 9-12). In combination, Kolodner and Smithline do not teaches synchronizing the processors so that all processors have completed the preceding phase prior to each processor beginning the next phase.

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Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Kolodner in view of Smithline and with the teachings of Lentz so as to obtain synchronization for plurality of processors in garbage collection in order to include a plurality of heaps, and each heap is associated for each processor for garbage collection. This combination would have

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made the system having synchronization between the phases in a plurality of heaps in shared memory having sweep and mark phases in a multiple processors environment.

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**Contact Information**

6. Any inquiry concerning this communication should be directed to Anh Ly whose telephone number is (703) 306-4527 or via E-Mail: **ANH.LY@USPTO.GOV**. The examiner can be reached on Monday – Friday from 8:00 AM to 4:00 PM.

If attempts to reach the examiner are unsuccessful, see the examiner's supervisor, John Breene, can be reached on (703) 305-9790.

Any response to this action should be mailed to:


Commissioner of Patents and Trademarks


Washington, D.C. 20231

or faxed to: (703) 872-9306 (Central Official Fax Number)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Fourth Floor (receptionist).

Inquiries of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.

  
JEAN M. CORRIELUS  
PRIMARY EXAMINER

  
ANH LY  
APR. 15<sup>th</sup>, 2004